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GB 1516311 GB 1202760
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(54) A system for monitoring the operation of output transducers of a central control and monitoring unit for machines and/or devices usable in production and/or product packaging lines

(57) In a system for the control and monitoring of machines and devices used in manufacturing or packaging, which system includes input transducers (switches) 2 linked to a central unit 3 which controls output transducers 9, an output circuit 7 between the central unit and the output transducer includes means for detecting current in the output transducer. As shown this circuit includes a transformer 41 and Hall device 50 associated with photodiodes 43 and 56 which indicate the presence of current in the output transducer.

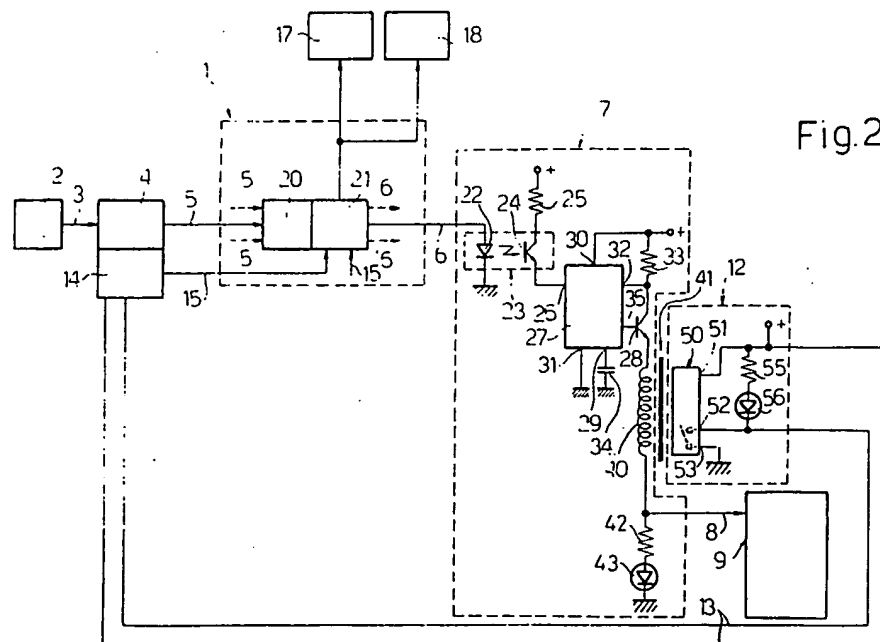


Fig.2

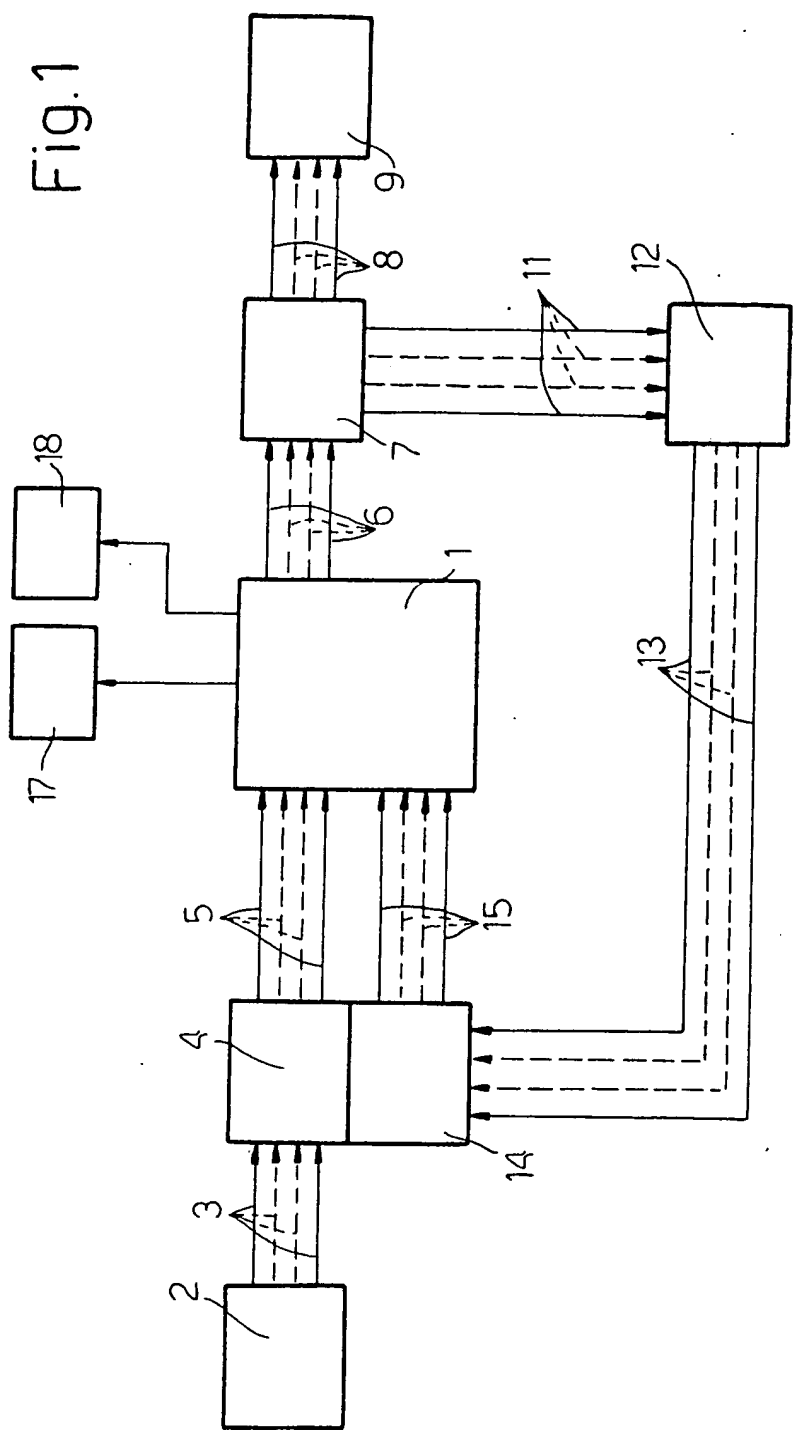
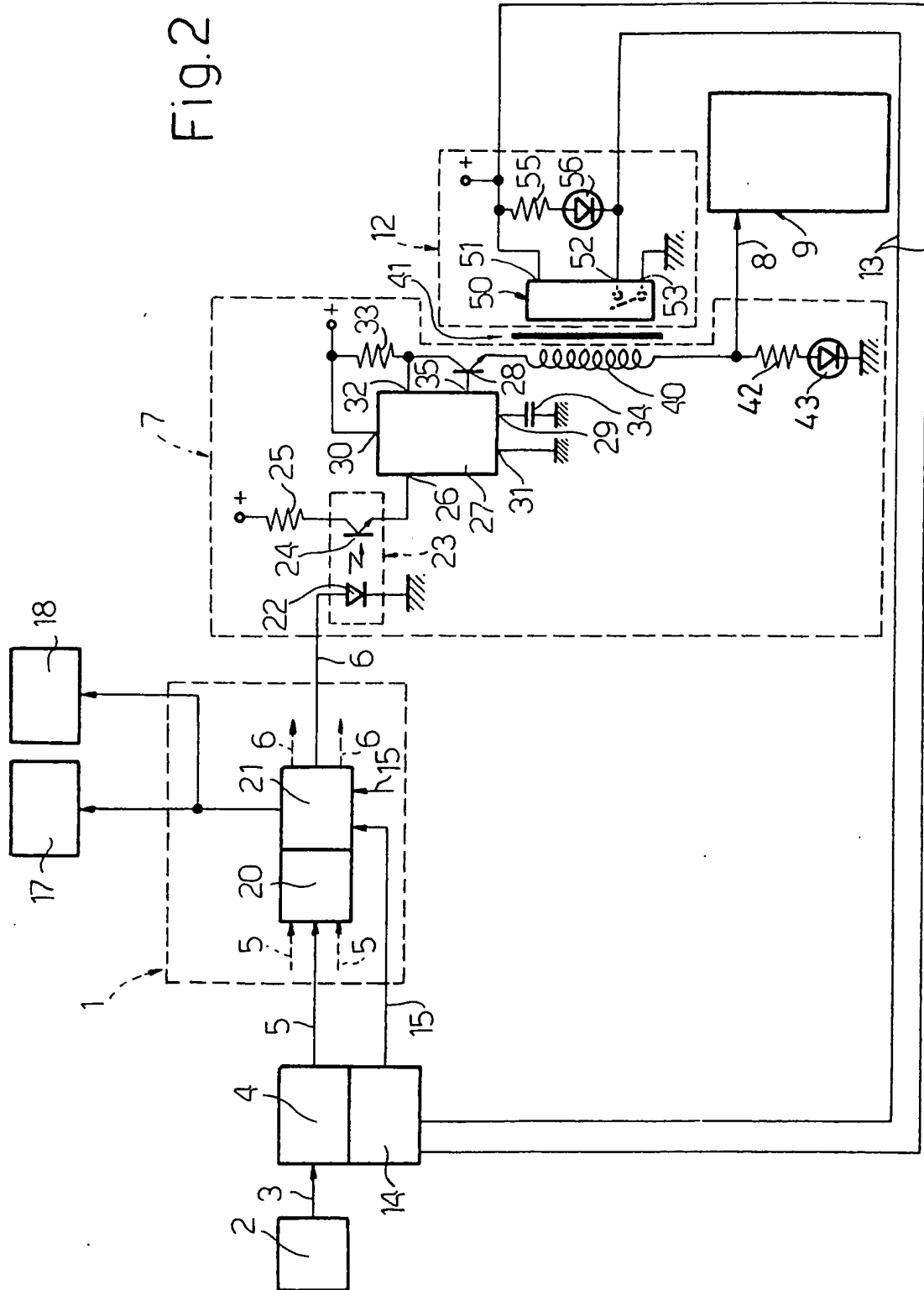


Fig. 1



SPECIFICATION

A system for monitoring the operation of output transducers of a central control and monitoring unit for machines and/or devices usable in production and/or product packaging lines

The present invention relates to a system for monitoring the operation of output transducers of a central control and monitoring unit for machines and/or devices usable in production and/or product packaging lines, for example, cigarette production lines and/or cigarette packet packaging lines; such lines can for example include cigarette making machines, filter fitting machines, packaging machines, cellophaning machines, cartonising and parcelling machines.

As is known, such individual machines or production lines are controlled by a central control and monitoring unit which in dependence on certain signals emitted by input transducers determine, at suitable instants, the operations of the various output transducers which can also belong to different machines in the same line.

Signals from such input transducers therefore arrive at this central control and monitoring unit via associated input circuits. Further, this central control and monitoring unit also effects the detection of the effect of the controls on the output transducers, via associated monitoring circuits which detect a voltage drop caused by the signal directed to the output transducer.

Such monitoring circuits are coupled to the said central unit by means of associated input circuits.

Upon detection of a defect in the transfer of control signals to the output transducers, the central unit controls a fault indication and stops the machine.

The object of the present invention is that of improving the system of monitoring the action of the output transducers for machines and/or devices of the type specified above, in such a way as to obviate the disadvantages inherent in voltage drop detection systems, and further to provide a very much more precise and detailed breakdown indication.

According to the present invention, there is provided a system for monitoring the operation of the output transducers of a central control and monitoring unit for machines and/or devices usable in production and/or product packaging lines, characterised by the fact that it includes means for detecting the passage of current in the said transducer.

For a better understanding of the present invention an embodiment will now be described, by way of non-limitative example, with reference to the attached drawings, in which:

Figure 1 is a block diagram of the output transducer operation monitoring system formed according to the present invention; and

Figure 2 is an electrical and block diagram of some component parts of the operation monitoring system of *Figure 1*.

With reference to *Figure 1*, a central control and monitoring unit for machines and/or devices usable in production and/or product packaging lines, in particular production and packaging of packets of

cigarettes, is generally indicated with the reference numeral 1.

As has already been indicated above, in a known configuration these lines include a plurality of input transducers 2 which are coupled by associated connections 3 to respective input circuits 4 which are connected via respective connections 5 to the central unit 1. This unit 1 is in turn connected by respective connections 6 to respective output circuits 7 which are connected via respective connections 8 to respective output transducers 9. The output circuits 7 are then respectively connected, via connections or couplings 11, to respective monitoring circuits 12 which are connected, via respective connections 13 to respective input circuits 14 connected via respective connections 15 to the central unit 1.

To this central unit 1 are then connected a fault display panel 17 and a block 18 for controlling the stopping of the machine or the line.

Each input transducer 2 is therefore connected, via a connection 3, to a respective input circuit 4 which is connected via a connection 5 to the unit 1. These input circuits 4 are therefore equal in number to the number of input transducers 2. Similarly, there are a corresponding number of output circuits 7 as there are output transducers 9, and an equal number both of the monitoring circuits 12 and the input circuits 14 and connections 15 between the unit 1 and the input circuits 14. As illustrated in detail in *Figure 2*, the various connections 5 from the various input circuits 4 are connected to a central processing block 20 of the unit 1 which sends a control signal to a respective output connection 6 via a comparison block 21. The connection 6, in the output circuit 7, is connected to the anode of a photo-diode 22, the cathode of which is earthed. This photo-diode 22 belongs to a photo-electric coupling device 23 which includes a photo-transistor 24, the collector of which is connected via a resistor 25 to a positive voltage supply terminal, whilst the emitter is connected to an input 26 of a circuit block 27 which provides protection against possible short circuits for an output transistor 28. This block 27 has a port 30 which is connected to a positive voltage supply terminal, a port 31 which is earthed, a port 32 to which is connected one end of a resistor 33, the other end of which is connected to a positive supply terminal, and a port 29 which is earthed through a capacitor 34. The port 32 is further connected to the collector of the transistor 28, the base of which is connected to another output port 35 from the block 27.

The emitter of the transistor 28 is connected to one end of a winding 40 of a coupling transformer 41 providing the coupling 11, the other end of which is connected to the connection 8, leading to the output transducer 9 and is earthed via a series connected resistor 42 and photo-diode 43, with the cathode connected to earth and conveniently emitting a red light. The output transducer 9 can be constituted by a relay, a remote control switch or a lamp, for example, in which case the output circuit 7 is constituted by a board, or can be, for example, constituted by a heavier load, for example, an electromagnet or a clutch, in which case the output

circuit 7 is formed by a convenient output module.

Via the transformer 41, the winding 40 is coupled to a Hall effect switching device 50 belonging to the monitoring circuit 12. In particular, this device 50 has a first port 51 connected to a positive supply voltage terminal, and two ports 52 and 53, the second of which is connected to earth, between which is established a connection in the presence of a magnetic field generated by the current which flows through the winding 40. Between the ports 51 and 52 there is arranged, in series, a resistor 55 and a photo-diode 56, this latter having its cathode connected to the port 52 and conveniently emitting a green light. The positive voltage supply port and the port 52 are then connected to the connections 13 leading to the input circuit 14.

The operation of the output transducer operation monitoring system formed according to the present invention is as follows.

After the central unit 1, following a signal from the connection 5, has sent a suitable signal on the connection 6 towards a respective output circuit 7 the transistor 28 is activated to control the supply via the connection 8 to the output transducer 9. Through the coupling transformer 21 the closure of the switch between the ports 52 and 53 occurs so that a signal for the input circuit 14 is generated, which, via the connection 15, determines the comparison signal for the comparison block 21 which therefore allows normal operation of the unit 1.

In the event of a breakdown in the control for the output transducers 9, the current in the winding 40 is lost so that the connection between the ports 52 and 53 remains open and therefore the comparison signal on the connection 15 to the block 21 is lost, which therefore determines a fault indication on the block 17 with convenient indication of the output circuit 7 of the various output circuits 7 of the machine or the line which has failed, and with control to the block 18 which stops the machine.

On the basis of the indication on the block 17 the operator at this point can go and observe, in the output circuit 7 and in the monitoring circuit 12 involved, the state of the photo-diodes 43 and 56. In fact, in the event of a breakdown in the connection 8 leading to the output transducer 9, the substantial output current in the winding 40 is lost so that the photo-diode 56 will be extinguished whilst the photo-diode 43 will be illuminated. On the other hand, in the case of failure in the output circuit 7, so that even the minimum output current in the transistor 28 is lost, both the photo-diodes 43 and 56 will be in an extinguished state. In this way the operator can immediately analyse if the fault is in the output circuits 7 or in the connection 8 leading to the output transducer 9, which can be a significant distance from the output circuit 7 itself.

In the event of correct operation, however, both the photo-diodes 42 and 56 are illuminated. Further, in the event of short circuit of the output of the transistor 28 the voltage across the terminals of the resistor 33 increases, which is detected by the block 27 which therefore causes the transistor 28 to switch off for a time period predetermined by the capacitor 34. At the end, in fact, of the time constant deter-

mined by the capacitor 34, the transistor 28 is enabled again and in the event of a continuation of the existence of a short circuit condition the transistor 28 is again switched off as described above.

There are therefore various advantages obtained with the system for monitoring the operation of output transducers 9, formed according to the present invention; first of all the monitoring circuit 12 acts to monitor the current rather than the voltage to detect if the output transducer 9 is working or not, via the coupling formed with the transformer 41, thereby avoiding voltage drops on the connection to the transducer 9 itself; further by means of the photo-diodes 42 and 56 there is obtained a selective indication of the zone of the possible fault thereby simplifying maintenance.

Finally, it is clear that the described embodiment of the monitoring system for output transducers of the present invention can be modified and varied without departing from the scope of the invention itself.

CLAIMS

1. A system for monitoring the operation of output transducers 9 of a central control and monitoring unit for machines and/or devices usable in production and/or product packaging lines, characterised by the fact that it includes means for detecting the passage of current in the said transducer.

2. A system according to Claim 1, characterised by the fact that the said means includes a Hall effect switching device.

3. A system according to Claim 1 or Claim 2, characterised by the fact that the said output transducer is connected to the said central unit by an output circuit, the said means being disposed in a monitoring circuit coupled to the said output circuit.

4. A system according to Claim 3, characterised by the fact that it includes second means operable to detect and selectively indicate possible operational faults in the said output circuit or in the connection leading to the said output transducer.

5. A system according to Claim 4, characterised by the fact that the said second means include selective luminous indicators.

6. A system according to Claim 5, characterised by the fact that the said second means include a first luminous indicator connected to the output of the said output circuit upstream of the said connection leading to the said output transducer, and a second luminous indicator which can be activated by the said means disposed in the said monitoring circuit for detecting passage of current in the said transducer.

7. A system according to Claim 6, characterised by the fact that the said luminous indicators are of different colours.

8. A system according to any of Claims 3 to 7, characterised by the fact that the said central unit is connected to the said output circuit by photo-electric coupling means.

9. A system according to any of Claims 3 to 8, characterised by the fact that in the said output circuits there are disposed circuit means operable to

detect a short circuit condition for a power supply element supplying power to the said transducer and to switch off, respectively, and for a predetermined time period, the supply to the said output circuit

5 leading to the said transducer.

10. A system according to any of Claims from 3 to 9 characterised by the fact that it includes a comparison circuit in the said central unit, the said comparison circuit emitting a control signal for the
10 said output transducer and further receiving a comparison signal from the said monitoring circuit in dependence on the said means for detecting the passage of current in the said transducer, the said comparison circuit emitting a signal for a circuit to
15 control stopping of the said machine and/or device, and for a selective luminous indicator in the event of loss of the said comparison signal.

11. A system according to any preceding Claim, characterised by the fact that the said machines
20 and/or devices are usable in lines for the production of cigarettes and/or for the packaging of packets of cigarettes.

12. A system for monitoring the operation of output transducers of a central control and monitor-
25 ing unit for machines and/or devices usable in production and/or product packaging lines, substantially as described with reference to the attached drawings.

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